

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
9 March 2006 (09.03.2006)

PCT

(10) International Publication Number  
**WO 2006/025045 A1**

(51) International Patent Classification:  
A61B 1/015 (2006.01) A61B 1/12 (2006.01)  
A61M 1/00 (2006.01)

Yehuda (IL). LEVY, Avi [IL/IL]; 37/9 Asher Barash St., Herzlyia (IL).

(21) International Application Number:  
PCT/IL2005/000867

(22) International Filing Date: 10 August 2005 (10.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/606,976 3 September 2004 (03.09.2004) US  
60/608,432 9 September 2004 (09.09.2004) US

(71) Applicant (for all designated States except US): SightLine Technologies Ltd. [IL/IL]; MATAM, Advanced Technology Center, 31905 Haifa (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): AIZENFELD, Amram [IL/IL]; Kibbutz Ramot Menashe, 19245 (IL). LEVIN, Victor [IL/IL]; 29/4 Yair Shtern St., Haifa (IL). GOLAN, Salman [—/IL]; 27 Nuri David St., 30200 Tirat Hacarmel (IL). SHEZIFI, Omer [IL/IL]; 74 Yakinton St., 34792 Haifa (IL). OZ, Dan [IL/IL]; 18 Vatikim St., Even

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

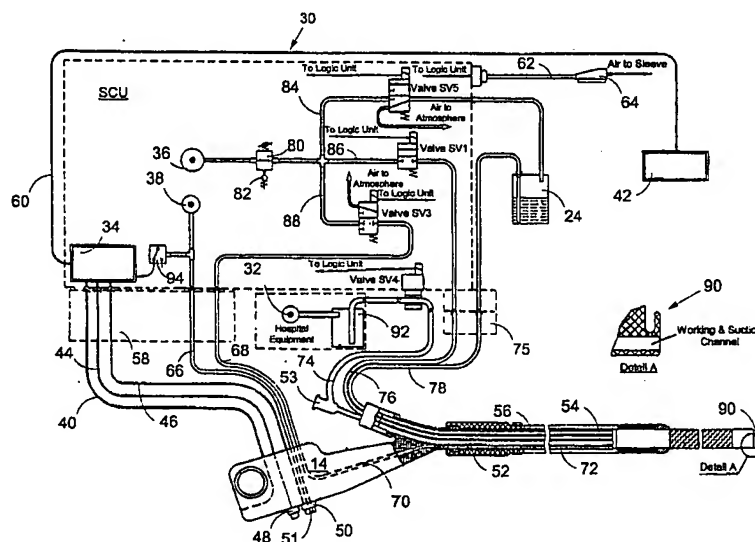
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONTROL SYSTEM FOR SUPPLYING FLUID MEDIUM TO ENDOSCOPE



(57) Abstract: A control system for supplying fluid medium to an endoscopic apparatus which comprises an operation handle and an insertion tube provided with an insufflation channel, an irrigation channel and a suction channel extending therealong. The control system is provided with a system control unit with at least one source of a first fluid medium, with a source of a second fluid medium, with a source of vacuum and with a multifunctional connector for bringing the operation handle in fluid and electrical communication with the system control unit. The source of the first fluid medium and the source of the second fluid medium are simultaneously connectable to and disconnectable from the insufflation channel and the irrigation channel.

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
9 March 2006 (09.03.2006)

PCT

(10) International Publication Number  
**WO 2006/025045 A1**

(51) International Patent Classification:  
**A61B 1/015** (2006.01) **A61B 1/12** (2006.01)  
**A61M 1/00** (2006.01)

Yehuda (IL). LEVY, Avi [IL/IL]; 37/9 Asher Barash St., Herzlyia (IL).

(21) International Application Number:  
PCT/IL2005/000867

(22) International Filing Date: 10 August 2005 (10.08.2005)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
60/606,976 3 September 2004 (03.09.2004) US  
60/608,432 9 September 2004 (09.09.2004) US

(71) Applicant (for all designated States except US): **SightLine Technologies Ltd.** [IL/IL]; MATAM, Advanced Technology Center, 31905 Haifa (IL).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **AIZENFELD, Amram** [IL/IL]; Kibbutz Ramot Menashe, 19245 (IL). **LEVIN, Victor** [IL/IL]; 29/4 Yair Shtern St., Haifa (IL). **GOLAN, Salman** [—/IL]; 27 Nuri David St., 30200 Tirat Hacarmel (IL). **SHEZIFI, Omer** [IL/IL]; 74 Yakinton St., 34792 Haifa (IL). **OZ, Dan** [IL/IL]; 18 Vatikim St., Even

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

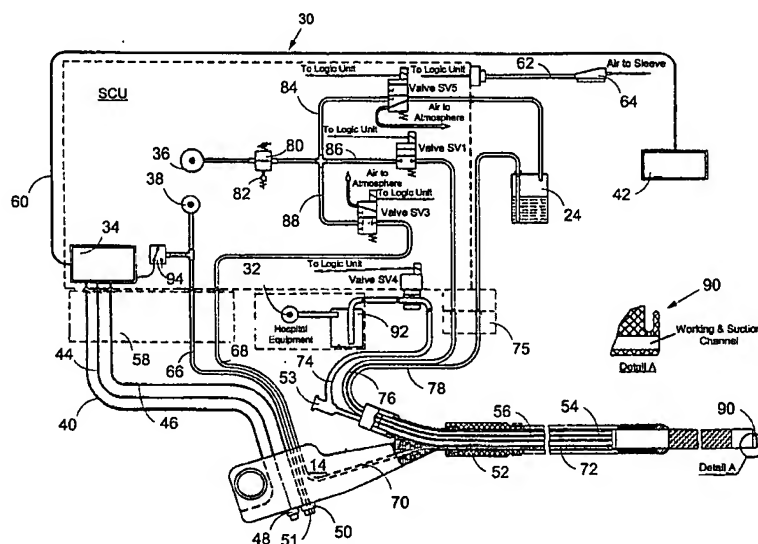
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: CONTROL SYSTEM FOR SUPPLYING FLUID MEDIUM TO ENDOSCOPE



(57) Abstract: A control system for supplying fluid medium to an endoscopic apparatus which comprises an operation handle and an insertion tube provided with an insufflation channel, an irrigation channel and a suction channel extending therealong. The control system is provided with a system control unit with at least one source of a first fluid medium, with a source of a second fluid medium, with a source of vacuum and with a multifunctional connector for bringing the operation handle in fluid and electrical communication with the system control unit. The source of the first fluid medium and the source of the second fluid medium are simultaneously connectable to and disconnectable from the insufflation channel and the irrigation channel.

## Control System For Supplying Fluid Medium To Endoscope

### Field of the invention

The present invention relates generally to the field of endoscopy and specifically to  
5 endoscopic apparatus used for colonoscopic procedures during which a flexible tube is  
inserted into the rectum and colon for examination of the colon interior for abnormalities.  
More particularly, the present invention refers to a control system for supplying a fluid  
medium, e.g. air, water etc. to the endoscope.

### Background of the invention

10 There are known endoscopes employing inflatable flexible sleeves for propulsion  
endoscope within colon.

Voloshin (US 6,485,409) discloses an endoscope, which comprises an endoscopic  
probe, a bending section for directing the probe within the colon (steering unit), an  
insertion tube and a flexible covering sleeve or a sheath, which is coupled proximally to the  
15 probe. The bending section of the endoscope is located behind the probe. The sleeve is  
attached to the endoscope in such a manner that its folded section is retained between a cap  
and an internal spindle, which are located between the insertion tube and the probe head.  
When inflated, the folded section unfolds over a flange of the internal spindle and an inner  
portion of the sleeve is pulled in a distal direction.

20 In PCT/IL03/00661 an endoscope is described which employs a flexible inflatable  
sleeve, which before inflation is retained within a dispenser. The dispenser employed in this  
endoscope has entry and exit ports defining a transit passage through which the endoscope  
may pass. The dispenser is adapted to capture the sleeve as the endoscope is retracted  
through the transit passage in a proximal direction. In another embodiment, the dispenser  
25 includes an external sleeve fixed to the dispenser and this external sleeve is adapted to be

extended from the dispenser when the endoscope is retracted so that the external sleeve covers the flexible sleeve. By virtue of this provision any contamination on the flexible sleeve remains within the external sleeve and does not contact the endoscope or any other objects or areas outside the patient's body. After the endoscope has been removed entirely  
5 from the flexible sleeve, the dispenser together with the external sleeve is discarded.

It is mentioned in the above reference that the endoscope is provided with an internal sleeve, which is also known as multilumen tubing, since it is usually fitted with appropriate passages or lumens as required for irrigation, ventilation, suction and for passing endoscopic tools therethrough. To operate the endoscope, the proximal end of the  
10 multilumen tubing is detachably connected via a dedicated disposable connector, or so called hub, to a source of fluid medium, i.e. water, compressed air and vacuum. A fluid control system is provided, which comprises an external control unit with a pump for supplying compressed air, a flask for supplying water and a pump for producing vacuum. The control unit is provided also with several pinch valves, which control the supply of  
15 compressed air, water and vacuum to the multilumen tubing and compressed air to the inflatable sleeve.

Unfortunately maintenance of the endoscope provided with the above mentioned fluid control system is inconvenient and labor consuming, since before putting it into operation each tube should be connected one by one with a corresponding source of fluid  
20 medium.

The other disadvantage of the prior art control systems lies in the fact that it does not sufficiently prevent entrance of contaminated debris from the body channel back to the system.

### **Summary of the Invention**

The object of the present invention is, therefore, to provide a new and improved control system and system control unit for supplying fluid medium to the multilumen tubing and/or to the inflatable sleeve of an endoscope provided with such a sleeve.

- 5        A further object of the invention is to provide a new and improved system and system control unit, which is convenient and simple in operation and maintenance.

Still a further object of the invention is to provide a new and improved control system and system control unit, which reliably prevents entrance of contamination from the body channel during the endoscopic procedure.

- 10       For a better understanding of the present invention as well of its benefits and advantages, reference will now be made to the following description of its embodiments taken in combination with the accompanying drawings.

### **Brief Description of the Drawings**

- 15       Fig.1 depicts a general view of an endoscopic apparatus employing the control system of the invention.

Fig.2 depicts an embodiment of the control system and system control unit of the present invention

- 20       Figs.3 depicts a second embodiment of the control system and system control unit of the present invention

Fig.4 is a sectional view, depicting a contamination trap employed in the control system of the present invention.

### **Detailed Description of the Invention**

With reference to Fig.1 an endoscopic apparatus, preferably a colonoscopic apparatus 10, is shown with its following main components. The apparatus comprises an endoscope having an insertion tube with its proximal section 12 connected to an operation handle 14 and with its distal section 16 inserted in and protruding from a disposable dispenser 18. An example of such an apparatus and a general explanation of its construction and functioning can be found in the application PCT/IL03/00661 herein incorporated by reference.

It is shown also in Fig.1 that a disposable inflatable sleeve covers the distal region of the endoscope. That part of the sleeve, which is seen in Fig.1, comprises a frontal noninflatable portion 15 and a rear folded portion 17. The frontal portion covers the distal section of the endoscope and its head. The frontal portion does not inflate when the endoscope advances within the colon. The rear portion covers the insertion tube and unfolds when air or another fluid medium inflates the sleeve. By virtue of this provision the endoscope is propelled within the body passage. An explanation of this phenomenon can be found in the above referred-to reference. The endoscope, which can be used with the control system of the present invention, can be of similar type in the sense that it employs the same propelling mechanism, which is based on inflation of a flexible sleeve coupled to the endoscope's distal section. It should be appreciated, however, that the present invention is not limited merely to colonoscopy as such and to endoscopes, which are propelled by inflatable sleeve. It can be employed in any other endoscopic apparatus used for medical procedures requiring insertion of a probe in a body passage for inspection of its interior.

It is seen also in Fig.1, that the handle is connected by an umbilical cord 20 to a system control unit (SCU) 22. Within the housing of the SCU there is provided a source of compressed air for inflating and venting the sleeve. Proximate to the system control unit, a flask 24 is provided, which is filled with water, to be supplied under pressure into the colon for irrigation. It is not shown specifically, but should be appreciated that appropriate tubes extend along the umbilical cord for supplying air for insufflation and for supplying vacuum produced by appropriate means (not shown in Fig.1). The SCU is one of the main parts of the control system and it will be explained in more details in connection with Figs.2-4.

One should also bear in mind that within the insertion tube are provided various devices, which are necessary for functioning of the colonoscopic apparatus. These devices are known per se. Among such devices one can mention e.g. vertebrae and strings, which can be manipulated by the operation handle. It is not seen in Fig. 1, but should be appreciated, that along the colonoscope extends a multilumen tubing with appropriate passages for supplying water, as required for irrigation of the colon, air as required for insufflation and vacuum as required for suction. The multilumen tubing also allows introduction of surgical instruments into the colon as might be required during the colonoscopic procedure.

The multilumen tubing extends through the entire length of the endoscope, passes the handle and is connected to a dedicated Y-connector 26, which is detachably connectable to a lateral port provided on the handle, so as to connect the proximal end of the multilumen tubing with tubes 28 extending along the umbilical cord and supplying water and air from the SCU to the multilumen tubing.

In practice the multilumen tubing and the Y-connector are manufactured from plastic material. It would be advantageous if they are cheap, disposable items, which are discarded at the end of the endoscopic procedure after the colonoscope has been evacuated from the body passage. By virtue of this provision preparation to the new colonoscopic procedure is simple, convenient and fast and it is not associated with spreading of any contamination picked up from the body passage during the previous endoscopic procedure.

Referring now to Fig. 2 a first embodiment of the fluid control system of the invention is seen. The system is designated by reference numeral 30 and its main component, i.e. the SCU is designated schematically by a dotted line. The SCU controls supply of air, water and vacuum as required for proper functioning of the colonoscopic apparatus 10. Some external components of the fluid control system, namely flask 24 and vacuum pump unit 32, are also seen. In practice the flask volume should be sufficient to contain about 300 cc of water. As a suitable source of vacuum one could use available hospital equipment capable of producing a vacuum of -0.4 bar to enable suction from the body passage through the multilumen tubing with a flow rate of at least 20 liter per minute. The multilumen tubing is seen in Fig.2 and it is designated by reference numeral 33.

Within the SCU are provided the necessary electronic, pneumatic and hydraulic components, e.g. a logic unit 34, a first and a second pump 36,38 for supplying compressed air and various valves as will be explained later on. It is not shown specifically but should be appreciated that appropriate power supply means can be also provided within the SCU  
5 as required for activation the valves and energizing the logic unit.

In practice the pump 36 should be capable to supply air under pressure 0.5-0.7 bar with a flow rate 3-5 liters per minute. This pump is intended to supply compressed air to the multilumen tubing, to the inflatable sleeve and to the flask. The pump 38 should be capable of supplying air under pressure 0.3 bar with a flow rate 2 liter per minute. This pump is  
10 intended for supplying air to the operating handle. The operating handle has an opening for releasing the air. The purpose of this arrangement will be explained further.

The logic unit 34 is electrically connected by a line 40 to auxiliary control buttons provided on the handle 14 (not seen). The auxiliary control buttons might be available for controlling a video signal supplied to a monitor 42, e.g. for saving or freezing the displayed picture.

15 The logic unit is also electrically connected by signal lines 44, 46 to respective control buttons 48 and 50 provided on the handle. The button 48 enables controlling of suction through a channel 52 made in the multilumen tubing. This channel functions either as a suction channel (when vacuum is supplied therethrough) or as a working channel when it is required to insert a surgical tool through a port 53. The button 50 enables supply of air to  
20 the body passage through a dedicated insufflation channel 54. This button also enables the supply of water to the body passage through a dedicated irrigation channel 56. A through going opening 51 is provided in the button 50. This opening can be closed or opened by the doctor's finger during operating of the handle. The through going opening is in flow communication with the pump 38. For connecting the SCU with lines 40, 44 and 46 a  
25 detachable multifunctional connector 58 is provided. This connector is multifunctional in the sense that it enables not only passing electrical signals between the SCU and control buttons 48,50 and auxiliary control buttons, but also ensures supplying of compressed air to the handle. The logic unit 34 is electrically connected by a line 60 with the monitor and by a line 62 to a foot pedal 64, which upon pressing generates a signal, which triggers inflation



of the sleeve. The connection of line 62 to the logic unit is schematically designated in Fig.2 by an arrow with the label "to logic unit".

In Fig.2 are also seen tubes 66,68, which allow flow communication between the SCU and the handle. The tubes are detachably connected to the SCU by virtue of the same multifunctional connector 58. It is seen that tube 66 serves for supplying pressurized air from pump 38 to opening 51 in the button 50. It is also seen that tube 68 supplies pressurized air from pump 36 to the handle. Within the handle there is provided a passage 70 through which compressed air from pump 36 proceeds to a channel 72 extending through the insertion tube for inflating the sleeve.

It is shown also in Fig.2 that the multilumen tubing is in flow communication with the SCU via tubes 74,76,78, which are connected to the Y-connector 26 provided at the lateral extension of the handle. These tubes respectively supply vacuum to the working channel 52, air to the insufflation channel 54 and water to the irrigation channel 56. A common connector 75 is provided for simultaneous bringing in fluid communication of tube 76 with pump 36 and tube 78 with flask 24. In accordance with one of the aspects of the present invention tubes 76,78 are immediately connectable and disconnectable to the respective source of air and water without the necessity to connect/disconnect the tubes one by one by separate connectors dedicated to each line. This provision renders the setting up of the system very simple, convenient and fast. It is not shown specifically but should be appreciated that the common connector could be arranged at the flask, e.g. in its cover.

Within the SCU are mounted various hydraulic and pneumatic components of the system, which are necessary for controlling supply of the fluid medium to the colonoscope. The fluid medium is supplied by the following supply lines: line a) for supplying of compressed air from pump 36 to the sleeve, to the multilumen tubing and to the flask; line b) for supplying vacuum produced by vacuum pump 32 to the multilumen tubing; line c) for supplying of compressed air from pump 38 to the handle; and line d) for supplying of water from flask 24 to the multilumen tubing.

It is seen, for example, that in the line a) there is provided a pressure regulator 80 with a safety valve 82 for keeping the pressure supplied by pump 36 within a narrow range of 0.5-

0.7 bar. The pressurized air proceeds via three ducts 84,86,88 to three normally shut off solenoid valves SV5, SV1 and SV3. These valves, when opened, enable supply of pressurized air from the pump either to flask 24, or to line 76, or to line 68. As soon as pressurized air is supplied to the flask, water within the flask is urged to proceed via tube  
5 78 to the irrigation channel of the multilumen tubing so as to be ejected therefrom by means of a sprinkler means 90 provided at the forwardmost end of the colonoscope. In practice water is ejected from the flask with a flow rate of at least 1 cc per second. It can be readily appreciated that pressure is not permanently maintained within the flask, but only when it is required to supply water for irrigation.

- 10 In the line b) there is provided a suction bottle 92 and a suction valve SV4, which is a conventional pinch valve capable of selectively releasing the tube 74 passing therethrough. Pressing suction button 48 on the handle 14 actuates this pinch valve.

It should be appreciated that all valves are electrically connected to the logic unit and are controlled thereby.

- 15 In the line c) there is provided a pressure sensor 94, which senses air pressure in the line 66. The pressure sensor is electrically connected to the logic unit and as soon as the air pressure in line 66 reduces below a certain preset level the sensor generates and sends to the logic unit a signal. Upon receiving this signal the logic unit opens valve SV1 and pressurized air is supplied via line 76 to the insufflation channel of the multilumen tubing.

- 20 The control system depicted in Fig.2 operates as follows.

When it is required to inflate the sleeve, one should press foot pedal 64. Upon pressing the pedal, an electrical signal is transferred to the logic unit, which, in its turn, generates a signal for opening the normally shut-off valve SV3. When this valve opens, pressurized air is allowed to proceed from pump 36 to the sleeve via passage 70 in the handle and then via  
25 passage 72 in the insertion tube. In order to release pressure from the sleeve, one should release the pedal after evacuating the colonoscope from the body channel. In this situation, a signal is generated by the logic unit to close valve SV3 so as to enable release of pressure from tube 68 to the atmosphere.

When suction is required, one should press button 48. Upon pressing this button, a signal will be generated by the logic unit to open pinch valve SV4 and then vacuum will be allowed to proceed to the body cavity via tube 74 and suction channel 52.

For insufflation, one should close opening 51 provided on the control button 50. This  
5 causes an increase of pressure in line 66, which will be detected by pressure sensor 100. Accordingly the logic unit opens solenoid valve SV1 and pressurized air will be allowed to proceed from pump 36 through tube 76 to the insufflation channel.

It should be kept in mind that instead of opening 51 being closeable by a doctor's finger for triggering the air supply from pump 38, one could use a different arrangement, e.g.  
10 electrical two stroke switch.

To irrigate the body cavity one should deeply press control button 50. Then a signal will be generated by the logic unit to open valve SV5. Upon opening the valve, pressurized air is allowed to enter the flask and thus water is urged to proceed to the irrigation channel via tube 78. When there is no signal, the pressure is released from the valve immediately to the  
15 atmosphere and there is no pressure in the flask.

It should be readily appreciated that control buttons 48,50 are merely electrical switches, which are electrically connected to the logic unit and there is no flow communication between the buttons and the multilumen tubing. By virtue of this provision the danger of contaminating the buttons by any debris penetrating from the body channel or cavity is  
20 prevented. At the same time, since flow of air is permanently maintained in the direction from pump 38 to opening 51 it is possible to retain the same mode of carrying out the insufflation or irrigation, to which the doctors are so accustomed. In accordance with this mode a finger pressure on the hole in the center of button 50 provides insufflation and further depression of the button triggers the irrigation.

25 It should be also appreciated that, since the control buttons operate the valves electrically and not mechanically, there is no need for mechanical parts, like pistons etc. In the prior art systems the control buttons usually are associated with a mechanical control mechanism comprising mechanical parts. Due to inevitable contamination it is required to dismantle

the control mechanism and to clean it after each colonoscopy session. In the present invention the buttons are not associated with any mechanical parts, which could get contaminated.

Now a second embodiment of the present invention will be explained. This embodiment is depicted in Fig.3 and Fig.4 and it is intended to reduce as much as possible the probability of contamination from the body passage through the sleeve when it becomes punctured. Referring to Fig. 3 it is seen that most of the components of the system remain the same, however in contrast to the previous embodiment in the supply line a) there is provided a contamination trap means 96, which is located between the handle and valve SV3. In practice it would be preferable if the trap means resides within the connector 58 as seen in Fig.3.

The trap means is intended to prevent entrance of any contamination back to the SCU when flow communication is provided between the body channel or cavity and the SCU via channel 72, passage 70 and tube 68. Construction and functioning of the trap means will be explained in more details with reference to Fig.4.

Referring again to Fig.3 it is also seen that duct 88 splits at a knee 98 to form a lateral duct 100, leading to the trap means. Situated between the knee and the trap means a flow meter 102 is provided. This flow meter is required to detect the situation when the sleeve is damaged, e.g. punctured and it is required to terminate the inflation. It would be advantageous if in addition to the flow meter a manometer is provided to monitor any changes of pressure within the sleeve.

It is also seen that lines 76 and 78 are provided with dedicated check valves 104,106. By virtue of this provision passing of flow medium is permitted only in one direction, i.e. from the SCU and from the flask to the multilumen tubing while backward flow is prevented. By virtue of this provision it is possible to keep contamination from the inside of the SCU and the flask.

It should be appreciated that the elements of the above disclosed control system can be employed not only in a colonoscope, which is fitted with an inflatable covering sleeve.

They can be used in the control system of any other endoscope, in which it is required to supply fluid medium to the insertion tube.

Referring to Fig.3 and Fig.4 it is seen that trap means 96 is, in fact, a control valve, which is designed as a spool valve comprising a cylindrical housing 108 with residing therein a double piston, which design will be discussed further. Longitudinally extending along the housing a cylindrical bore is provided, which is defined by a short section 110, a long section 112, a right end R and a left end L. The inside diameter of the short section is  $D_s$ , while the inside diameter of the long section is  $D_l$  and it is seen that  $D_s$  is larger than  $D_l$ . At the right end of the bore there is provided a port 114 which is in fluid communication with a control line 115, through which compressed air is supplied from pump 36 via valve SV3. This air controls the position of the double piston within the housing. It should be appreciated, that in the embodiment of the control system, which is shown in Fig. 3 the valve SV3 operates as a normally open valve. It is seen in Fig.4, that on the peripheral wall of the long section 112 there are provided three ports 116,118,120. The port 116 is located close to the left end of the bore This port is intended to be in fluid communication with the lateral duct 100, through which compressed air is supplied to the trap means. The port 118 is located at the right of the middle of the long section and it is connected immediately to the atmosphere by a line 119. The port 120 is located at the left of the middle of the long section and its is intended to be in fluid communication with tube 68, through which compressed air is supplied from the trap to the sleeve. Within the housing the double piston is displaceable between the opposite ends L and R of the bore. The double piston comprises a first cylinder 122, an opposite second cylinder 124 and a rod 126, on which the cylinders are secured. The first cylinder is deployed within the short section 110 of the bore and its diameter is very close to the inside diameter  $D_s$ . The second cylinder is deployed within the long section 112 of the bore and its diameter is very close to the inside diameter  $D_l$ .

An O-ring or other suitable sealing is provided between each cylinder and the cylindrical periphery wall of the respective bore section. By virtue of this provision a fluid-tight engagement is ensured between the first and the second cylinder and the respective periphery wall of the bore when the piston slides reciprocatingly along the bore. The control system in accordance with this embodiment operates as follows. In a situation,

when there is no need to inflate the sleeve and/or a fluid medium should be released therefrom, the normally-opened valve SV3 allows compressed air to proceed from pump 36 via control line 115 to port 114 and to displace the piston to a left position, which is shown in Fig.4 by solid lines. It can be seen that in this position the first cylinder is abutted by the  
5 left end of the short section of the bore. The piston will retain in this position all the time when there is no signal from the logic unit to valve SV3. The length of the rod and of the cylinders as well as particular location of ports 116,118 and 120 is selected in such a manner, that when the piston is retained in the left position, cylinder 124 prevents flow communication between port 116 and ports 120, 118. Accordingly compressed air cannot  
10 proceed from duct 100 to the sleeve. At the same time, fluid medium is allowed to proceed from the sleeve to the trap (via port 120) and then to be released from the trap to atmosphere (via port 118). It should be appreciated that fluid medium releasing from the sleeve might be contaminated, however the SCU is fully prevented from being contaminated, since there is no fluid communication between ports 120,118 and ports  
15 116,114. Furthermore, compressed air, which enters the trap means via port 116, also contributes to preventing the entrance of contaminating debris to the SCU.

It would be advantageous to provide duct 100 with an auxiliary venting port, which would be located in vicinity of the trap or in the trap itself. Such a port would permanently release the air in the line to the atmosphere and this might reduce the probability of contaminating  
20 the SCU in the situation when the sleeve is deflated more than one time during the same endoscopy session.

In the situation, when it is required to inflate the sleeve, one should press foot pedal 64 and the logic unit will generate an appropriate signal for closing valve SV3. In this situation compressed air is released from the valve to the atmosphere and there is no pressure acting  
25 on the cylinder 122. Compressed air enters the trap via port 116 and acts on cylinder 124 so as to displace the double piston in the right position, which is shown in Fig. 4 by dotted lines. In this position port 116 is in fluid communication with port 120 and therefore compressed air is allowed to proceed from pump 36 to the sleeve.

It should be appreciated that the invention is not limited to the above-described

embodiments and that one ordinarily skilled in the art can make modifications or changes without deviating from the scope of the invention, as will be defined in the appended claims.

When used in the following claims, the meaning of terms “comprise”, “include”, “have”  
5 and their conjugates is “including but not limited to”.

It should also be appreciated that the features disclosed in the foregoing description, and/or in the following claims, and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realizing the present invention in diverse forms thereof.

10

**Claims:**

1. A control system for supplying fluid medium to an endoscopic apparatus, said apparatus comprising an operation handle and an insertion tube provided with an insufflation channel, an irrigation channel and a suction channel extending therealong, wherein said control  
5 system comprises:
- a) a system control unit fitted
    - with at least one source of a first fluid medium,
    - with hydraulic and pneumatic components enabling supply of the first fluid medium to the insertion tube and
    - 10 with a logic unit for controlling said hydraulic and pneumatic components,
  - b) a source of a second fluid medium,
  - c) a source of vacuum,
  - d) a detachable multifunctional connector effecting fluid and electrical communication between the operation handle and the system control unit.
- 15 wherein the said at least one source of the first fluid medium and the said source of the second fluid medium are simultaneously connectable to and disconnectable from the insufflation channel and the irrigation channel.
2. The control system as defined in claim 1, wherein said insertion tube comprises a multilumen tubing and said insufflation channel, said irrigation channel and said suction  
20 channel extend along the multilumen tubing.
3. The control system as defined in claim 1, wherein said at least one source of the first fluid medium comprises a pump for supplying compressed air, said source of the second fluid medium comprises a container filled with water and said source of vacuum comprises a vacuum pump.



4. The control system as defined in claim 3, wherein said at least one source comprises a first pump for supplying compressed air to the insufflation channel and a second pump for supplying compressed air to the operation handle.
5. The control system as defined in claim 4, wherein said operation handle comprises a control button provided with an opening, wherein upon closure thereof compressed air is supplied to the insufflation channel by said first pump.
6. The control system as defined in claim 5, wherein said second pump is in fluid communication with said opening.
7. The control system as defined in claim 6, wherein said second pump is in fluid communication with said opening via a pressure sensor.
8. The control system as defined in claim 3, wherein said pump is connected to the insufflation channel and to the container.
9. The control system as defined in claim 4, wherein said endoscopic apparatus is provided with an inflatable covering sleeve, said insertion tube being fitted with a channel for inflating the sleeve and said first pump being connected to the said channel for inflating the sleeve.
10. The control system as defined in claim 9, wherein said hydraulic and pneumatic components comprise normally closed valves, which are respectively located between the said first pump and between the said insufflation channel, the said receptacle and said channel for inflating the sleeve.
11. The control system as defined in claim 9, comprising a means for trapping contamination located between the first pump and the channel for inflating the sleeve.
12. The control system as defined in claim 11, wherein said means for trapping resides within the multifunctional connector.
13. The control system as defined in claim 11, wherein said means for trapping comprises a spool valve.

14. The control system as defined in claim 3, wherein said control system comprising a first check valve residing between the first pump and the insufflation channel and a second check valve residing between the container and the irrigation channel.

15. A system control unit for controlling supply of fluid medium into an endoscopic  
5 apparatus provided with an operation handle and with an insertion tube, wherein said system control unit comprises

at least one source of fluid medium,

hydraulic and pneumatic components enabling supply of the fluid medium  
to the insertion tube and

10 a logic unit for controlling said at least one source of fluid medium and said hydraulic and pneumatic components,

wherein said system control unit is in fluid and electrical communication with the operation handle and in fluid communication with the insertion tube.

16. The system control unit as defined in claim 15, wherein said fluid medium is air and  
15 said at least one source of fluid medium comprises

a first pump in fluid communication with an insufflation channel extending  
along the insertion tube and

a second pump in fluid communication with the operation handle.

17. The system control unit as defined in claim 16, wherein said second pump is in fluid  
20 communication with an opening made in a control button of the operation handle.

18. The system control unit as defined in claim 17, further comprising a pressure sensor residing between the second pump and the opening.

19. The system control unit as defined in claim 15, wherein said hydraulic and pneumatic components comprise at least one normally closed valve.

25

20. A method for controlling supply of air into an insufflation channel extending along an operating handle and an insertion tube of an endoscopic apparatus, said method comprises

a) providing a system control unit, which is in electrical and fluid communication with the operating handle, said system control unit being fitted

5 with a first pump for producing compressed air supplied to the insufflation channel,

with hydraulic and pneumatic components enabling supply of compressed air to the insufflation channel,

10 with a second pump for producing compressed air and being connected by a line to the operating handle, and

with a logic unit controlling said hydraulic and pneumatic components;

b) providing a control button at said operating handle, said control button having an opening which is in flow communication with the second pump; and

15 c) generating a signal for activating the hydraulic and pneumatic components to establish fluid communication between the first pump and the insufflation channel,

wherein said signal is generated by said logic unit upon terminating flow communication between the opening and the second pump.

20 21. The method for controlling supply of air as defined in claim 20, wherein said hydraulic and pneumatic components comprise at least one normally closed valve located between the first pump and the insufflation channel, said valve being openable upon receiving said signal.

25 22. The method for controlling supply of air as defined in claim 21, comprising sensing of pressure in a line between the second pump and the operating handle and generating said signal upon an increase of pressure up to a certain level.

23. The method for controlling supply of air as defined in claim 20, wherein terminating of flow communication between the second pump and the opening comprises closing said opening by a finger.

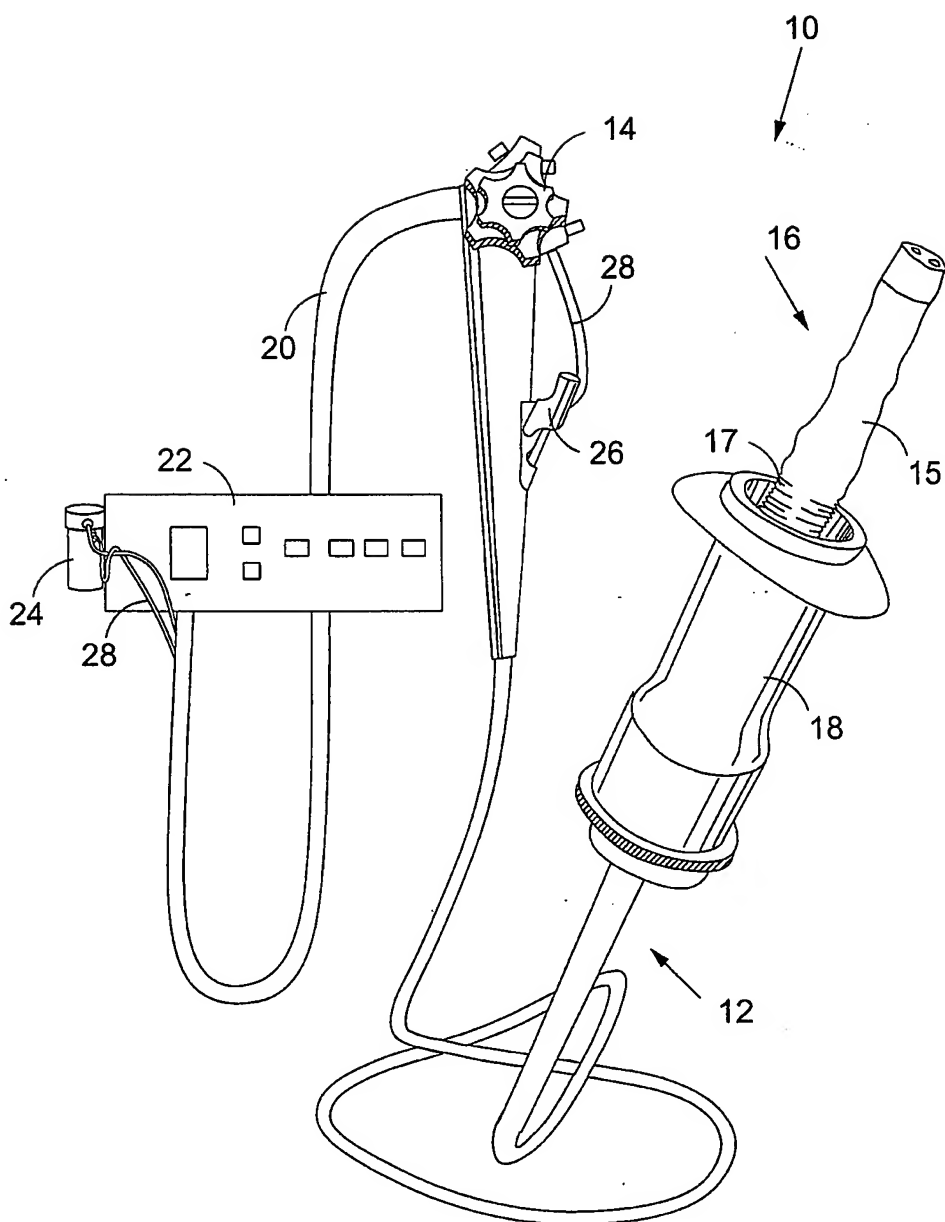
5

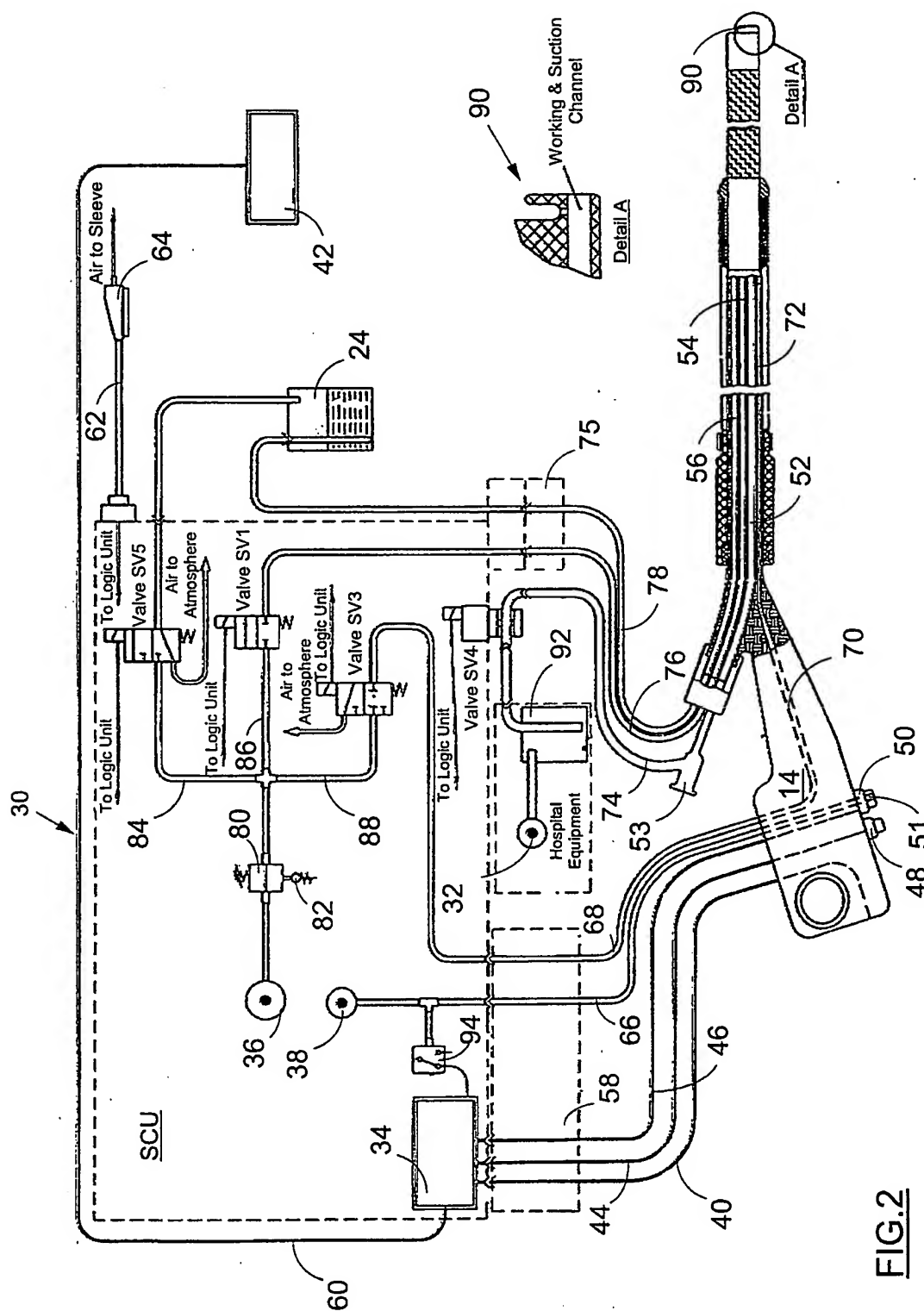
10

15

20

1/4

**FIG.1**



**FIG. 2**

3/4

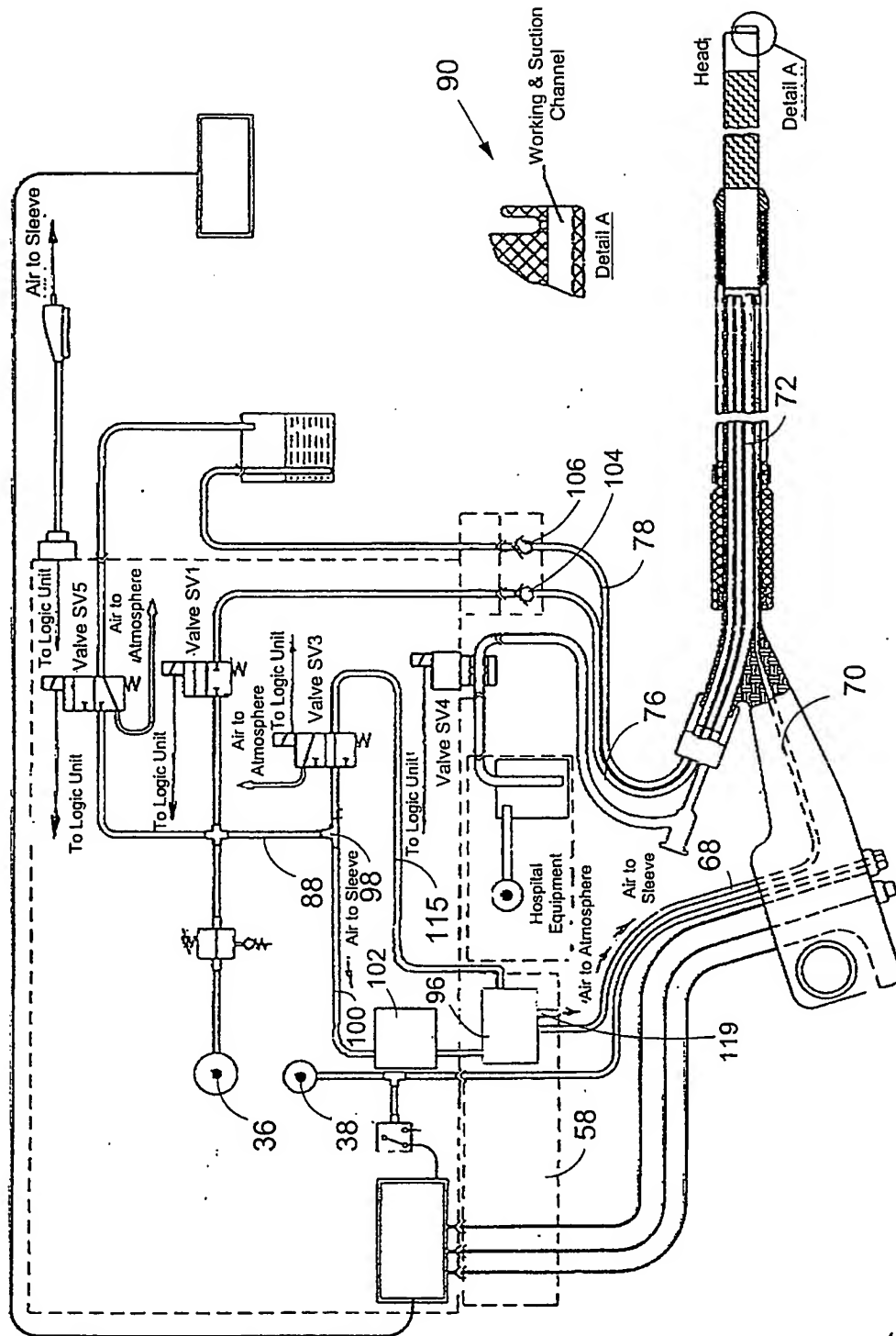
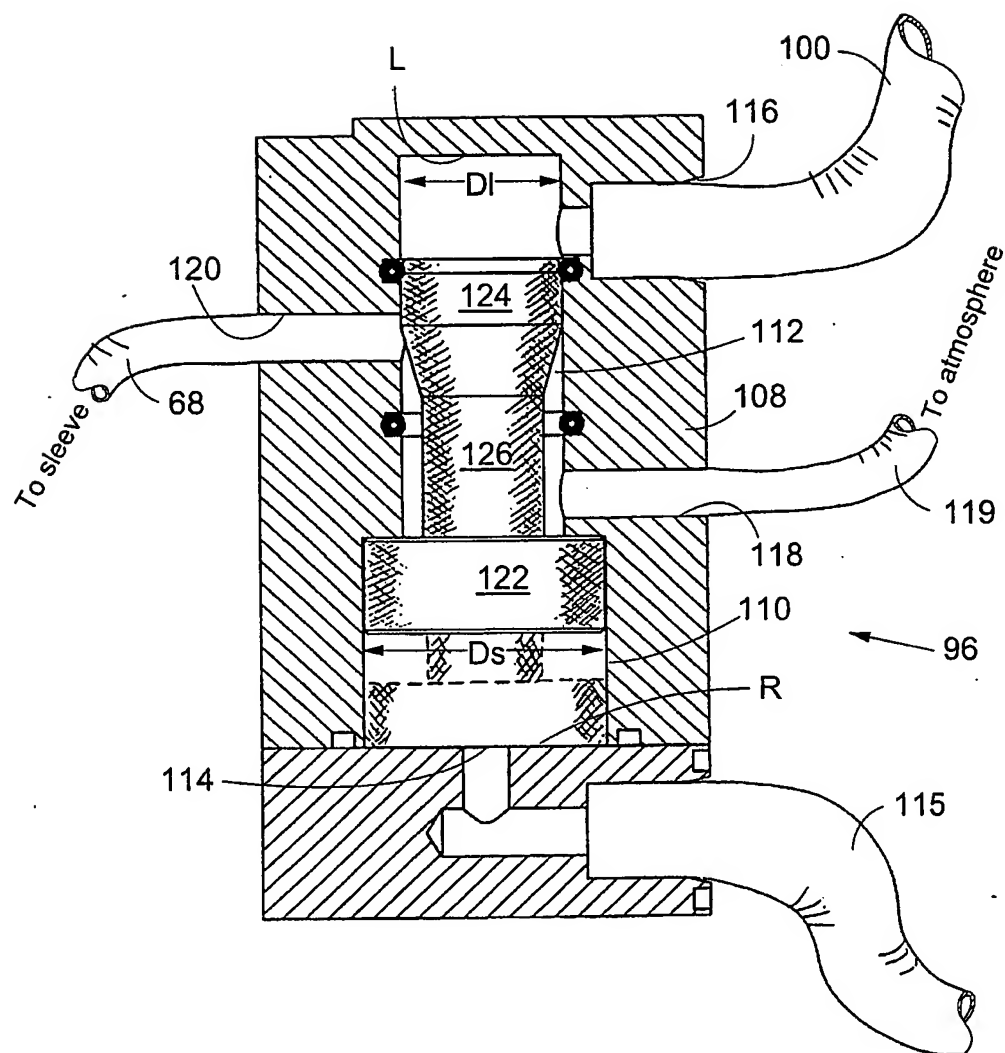


Fig. 3

4/4

**FIG.4**



## INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2005/000867

A. CLASSIFICATION OF SUBJECT MATTER  
 A61B1/015 A61M1/00 A61B1/12

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A61B A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X  A	US 2001/039370 A1 (TAKAHASHI KAZUAKI ET AL) 8 November 2001 (2001-11-08) figures 1-8 paragraph '0047! - paragraph '0102!	1-4, 8, 14-16  5-7, 9-13, 17-19
X  A	US 5 098 387 A (WIEST ET AL) 24 March 1992 (1992-03-24)  column 3, line 11 - line 68	15  1
X	US 6 096 008 A (KOREJWO ET AL) 1 August 2000 (2000-08-01) column 2, line 50 - column 3, line 55  ----- -/--	15



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\* & \* document member of the same patent family

Date of the actual completion of the international search

11 November 2005

Date of mailing of the international search report

23/11/2005

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
 NL - 2280 HV Rijswijk  
 Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
 Fax: (+31-70) 340-3016

Authorized officer

Rivera Pons, C

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IL2005/000867

## Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☒ Claims Nos.: 20-23  
because they relate to subject matter not required to be searched by this Authority, namely:  
Rule 39.1(iv) PCT - Method for treatment of the human or animal body by surgery  
It is clear from the description and the purpose of the invention that the steps are done on the human or animal body.
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box III Observations where unity of invention is lacking (Continuation of Item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2005/000867

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>DE 37 16 230 A1 (ASAHI KOGAKU KOGYO K.K;  ASAHI KOGAKU KOGYO K.K., TOKIO/TOKYO, JP)  19 November 1987 (1987-11-19)  column 4, line 20 - column 8, line 49  -----</p>	1-19

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/IL2005/000867

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2001039370	A1	08-11-2001	NONE	
US 5098387	A	24-03-1992	DE 3933856 A1 EP 0423062 A2	18-04-1991 17-04-1991
US 6096008	A	01-08-2000	DE 19652381 C1	16-07-1998
DE 3716230	A1	19-11-1987	NONE	